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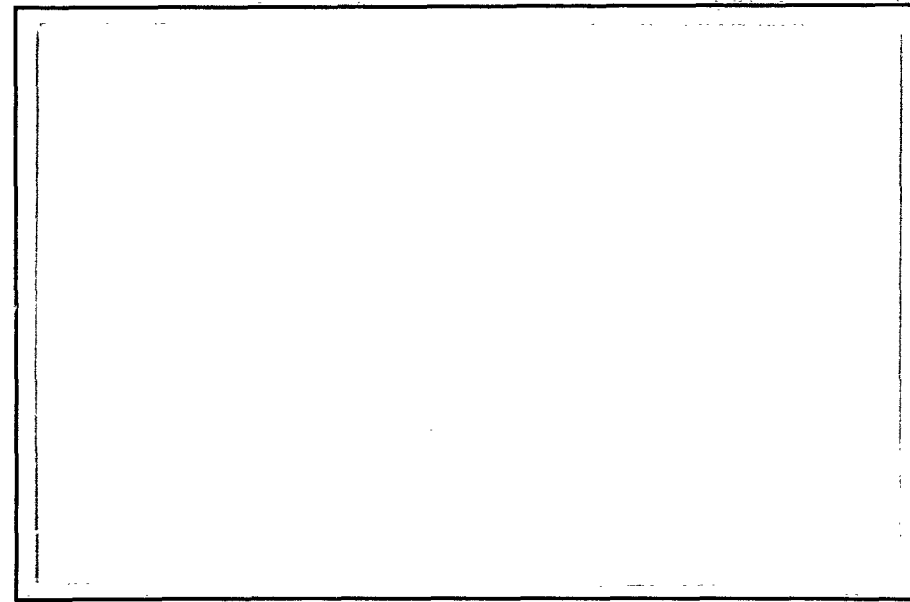
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TASK SILENCE

The Post-Midnight Alarm and Evacuation  
of Four Communities Affected by an  
Ammonia Gas Release

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## DIGEST

On 1 August, 1961, in Creve Coeur, Illinois, a rupture occurred in a four-inch high pressure hose carrying liquid anhydrous ammonia from a river barge to a terminal. Ammonia poured onto the dock, and a dense cloud of ammonia vapor quickly spread over the area. Workmen were forced to leave the dock before they could pull a safety valve control or cut off the tank valve control compressor. High pressure discharge continued for perhaps one half hour, and flow at ambient vapor pressure continued for almost two hours longer, by which time about 350 tons of liquid anhydrous ammonia had been lost. Although much probably poured into the Illinois River, enough was vaporized to blanket the river bottom area.

As the fumes spread, the residents of four towns were forced to evacuate their homes. Since the incident occurred in the early morning hours, extensive warning action was necessary to make certain that all residents were awakened and transported to safety. The evacuation was orderly, and no one was injured.

There was no overall coordination and direction of warning, evacuation, and rescue operations. Two intercommunity warning actions are known, calls from the Creve Coeur police dispatcher to Marquette Heights and to the Bartonville police. The communities on the east bank of the river cooperated with a minimum of formalities. Intercommunity communication by the police and fire radio nets appears to have been casual and under no restrictions. The coverage of the incident by the commercial radio stations supplied a measure of unofficial coordination and was an effective means of informing and advising residents after they had been awakened. The public accepted and acted on the information broadcast by the two commercial radio stations.

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## I. INTRODUCTION

### A. PURPOSES

The purposes of this investigation were: to determine the pattern of individual and community responses to an accidental ammonia vapor exposure at night; to relate these patterns to the social and political patterns of the communities involved, if possible; and to compile a body of data to be used in later comparative studies.

### B. APPROACH

Project Summit investigators visited the affected area for eight days during which they interviewed as many officials, rescue workers, and evacuees as possible. Respondents were interviewed informally and at some length. Attempts were made to cross check information wherever possible.

The investigators collected and studied a number of available documents in order to further acquaint themselves with the social structure, attitudes, traditions, economic patterns, and community resources in the area.

Supplementary information concerning a) the affected communities and b) the local structure of government is contained in the Appendices at the end of this report, much of the material for which was extracted from the Tri-County Planning Commissions's Planning Data, Phase I.

## II. THE EMERGENCY

Shortly after midnight August 1, 1961, Creve Coeur, Marquette Heights, North Pekin, and Bartonville, suburbs of Peoria, Illinois, were partially blanketed by a cloud of ammonia vapor released by the rupture of a hose being used in the discharge of a barge of anhydrous ammonia. See Figure 1.

At 11:00 p.m. on the evening of July 31, 1961, a Mid-South Chemical Company barge carrying 600 tons of anhydrous ammonia had tied up at the Cities Service Co. dock in the Illinois River along Wesley Road in the extreme southern corner of Creve Coeur, Illinois. Discharge of the ammonia was begun at midnight. An ammonia compressor at the terminal pumped vapor from the receiving vessel through a vapor line into the top of the barge tanks to force the liquid ammonia through the discharge hose and line into the receiving vessel at the terminal which was 3700 feet south of the dock. The operating pressure was reported not to have exceeded 180 pounds per square inch.

Spring loaded valves on each of the six barge tanks and on the liquid manifold to which they were connected were held open during discharge by air pressure supplied by an air compressor on the dock. A "dump" valve on the air line was operable by a rope which was strung to shore to permit emergency closing of the valves.

Two men were on the dock, and two had gone to the terminal to operate the discharge compressor. A former employee of the terminal was also at the dock. The tug had just returned to the barge from towing another barge to a dock upstream when the 4 inch discharge hose ruptured above the dock at about 12:15 a.m., 1 August 1961. Warned by a shout from shore, the tug captain pulled away. A heavy cloud of vapor immediately formed and spread in the dock area forcing the men on shore from the area before they could reach either the "dump" valve rope or the air compressor control to shut it off. The visitor drove off to notify the terminal crew to shut down the compressor. One of the dock crew drove a truck across the fields and railroad tracks and through Creve Coeur to get around the ammonia cloud to the terminal.



The other man, on his way to telephone for help at the nearest house, that of Ed Peterson, stopped on the way to help a woman driver turn her car to drive away from the cloud of ammonia, then woke the Petersons and used their phone to call the terminal and to call the fire department at about 12:20 a.m. With Mr. Peterson, he went up the road to waken neighbors while Mrs. Peterson prepared to leave. The cloud cut Mr. Peterson off a block from his home as he started back to take his wife out. She called the Creve Coeur police for help, and men with masks rescued her shortly.

The high pressure flow of liquid ammonia continued until the ammonia compressor at the terminal was shut down, possible by 12:30 a.m. The flow of liquid ammonia at its ambient vapor pressure continued until power to the air compressor controlling the barge tank valves was cut off by the electric power company between 2:00 and 2:30 a.m. allowing the tank and manifold valves to close. About 350 tons of liquid anhydrous ammonia were lost, much of which probably ran into the river before it could vaporize.

No further details as to warning and rescue or other activities of the dock and terminal crew were available, except that they continued their efforts to shut off the air compressor, accomplished when the electric power company cut off the power. The terminal crew was hampered in its efforts by a lack of adequate protective clothing and oxygen masks.

During the incident, the weather, as recorded at the Greater Peoria Airport, was partly cloudy, warm, and humid with variable easterly to southeasterly winds of 5 to 6 knots, which shifted to southerly by 6:00 a.m. The temperature ranged from 74° to 75° F. from midnight to 6:00 a.m. The relative humidity remained approximately 90% throughout the night. In the fluvial plain level, the humidity may have been higher, and there was probably some counter circulation of air and lighter winds.

The ammonia vaporized rapidly and spread over the immediate area quickly, forcing the abandonment of some fire and police vehicles as personnel without masks or with inadequate masks were cut off from their vehicles. It was necessary to assist some nearby residents out of the ammonia cloud. The vapor spread up and down the river bottom

into Creve Coeur, Marquette Heights, and North Pekin and across the river into Bartonville and threatened the southern part of Peoria. Warning action beginning about 12:45 a.m. cleared most of the areas affected in Creve Coeur, Marquette Heights, and North Pekin before the concentration became too great. The warning was initiated in Bartonville at 1:15 a.m. At 1:56 a.m. the U.S. Weather Bureau station at the Greater Peoria Airport recorded "visibility SE 4 ammonia gas drifting over field." The concentration was heavy enough on the western edge of Bartonville to severely damage a field of tomatoes. The approximate extent of the area affected by the ammonia vapor is shown by Figure 1.

Approximately 13,000 persons evacuated from the four towns, without accident or injury. About 40 persons received treatment in local hospitals for ammonia poisoning and a few for nervous exhaustion. Casualties were almost exclusively persons engaged in warning, rescue, and recovery work. No human deaths were known to have been caused by exposure to the ammonia vapor. Foliage was severely damaged in the area blanketed by the vapor, and "tons" of fish were killed in the river. A few small animal casualties were reported.

### III. THE EVACUATION

#### A. WARNING OPERATIONS

Warning activities were initiated from two sources: the telephone call from the dock worker to the North Pekin Fire Department, and a telephone "news tip" to radio station WIRL. The activities continued in two channels, with the commercial broadcasts indirectly supporting the official warning activities by providing additional details which could not be transmitted by the police and fire sirens.

The officials in the affected area were quickly notified. The North Pekin Fire Department operator sounded the siren and called the fire-police dispatcher in Creve Coeur requesting permission to send equipment to the dock, which is actually in Creve Coeur, even though it is closer to the North Pekin fire station. Permission was immediately granted. The Creve Coeur dispatcher began alerting the Creve Coeur Fire Department and contacted the Tazewell County Sheriff's dispatcher in Pekin to relay a warning to Marquette Heights. Police and fire units began to arouse and evacuate residents in the vicinity of the dock, but it soon became apparent that the situation was potentially quite serious. Requests for assistance brought in the East Peoria, Pekin, North Tazewell, Morton, and Ridgewood police and firemen, the Illinois State Police, Tazewell County Sheriff's deputies, Civil Defense officials, and emergency crews from the Caterpillar Tractor Company and the Central Illinois Light Company.

A warning to the Bartonville police brought the Bartonville Police and Fire Departments into action, soon assisted by the Peoria County Sheriff's deputies, Peoria city police, Illinois State Police, and Civil Defense officials.

Sirens, both fixed and mounted on vehicles, were used almost continuously throughout the emergency period. They were effective for specific functions with which they are traditionally associated. That is, they effectively cleared a path for emergency vehicles, and they summoned the members of the various

volunteer fire departments to the fire stations. But as a warning to the general public, they were generally less than adequate. Some people reported sleeping undisturbed while sirens wailed continuously nearby. Many who heard the sirens had no reason to believe that any warning was being directed at them and reported various interpretations of the sirens to mean fires, ambulances, police, etc. There seems to be little doubt that the general public has been thoroughly conditioned over the years to associate sirens with certain specific hazards and that general emergency or threat to the community is not one of these hazards. Sirens did not appear to be an adequate means of communication with the general public in this emergency. The Illinois Bell maintenance plant learned of the emergency from an employee and supplied a sound truck during the later portion of the activity. Loud speakers mounted on vehicles were used effectively to arouse and alert residents on both sides of the river. Similar failures to respond to sirens have been reported in surprise air raid alerts.

Door to door knocking, individual person-to-person telephone and personal warnings, and announcements by loud speaker trucks aroused those not awakened, or whose curiosity had not been sufficiently aroused by the sirens to turn on the radio, which was reporting the incident and the evacuation. The person-to-person contact was very important communication link in the warning activities. Police, fire, and civil defense personnel moved door-to-door through many neighborhoods rousing sleeping families and telling them to evacuate. More important, perhaps, were the many people who notified friends, neighbors, and relatives before or during their own evacuation. There were numerous reports of persons knocking on doors, telephoning, driving to a friend's or a relative's house to see if his car was gone, or of being picked up by a friend or acquaintance.

#### B. EVACUATION MOVEMENT

Evacuation began with the warning to the Creve Coeur residents in the vicinity of the dock where the leak occurred. Many were able to move out in their own vehicles, but police and fire vehicles were used to some extent to rescue some

residents who could not get out without help.

The time sequence of evacuation announcements and action is uncertain. However, the news announcement by radio stations WIRL, with some unrecorded advice that residents of the area should get out added impetus to the movement. A police officer in Marquette Heights received early warning of the danger from a North Pekin officer, and residents of the river bottomland portion of that community were warned and moved out.

At least some of the North Pekin volunteer firemen appear to have sent their own families up to the upper level of Marquette Heights for safety. They were reported to have arrived there early in the incident but without prior notice to the Marquette Heights officials, and to have had no advice as to evacuating any further.

Evacuation of the three communities, Creve Coeur, Marquette Heights, and North Pekin became general as the warning activities progressed. Movement was generally radially away from the site of the accident, though no definite pattern of movement was established. It does not appear that police officers and sheriff's deputies were given any specific instructions as to channeling the traffic. The principal activities seem to have been to slow it down. Although it appears from comments that the people were "bent on getting out," only one very minor accident was reported.

Individual cases of movements reported suggest that travel toward East Peoria and then across the river into Peoria was relatively unimpeded, but that efforts to go south to Pekin met traffic interference. Nevertheless approximately 250 to 400 persons went to the Pekin High School which was opened as a shelter.

Residents of the three east bank communities generally went to Groveland, Morton, and East Peoria, as well as to Pekin, though it is not certain that radio announcements had been made of reception center openings at any place east of the river except at Pekin High School. Some crossed into Peoria to families or



friends, and possibly to the reception centers there, the opening of which had been announced by radio. The evacuation movement was not identified as being in conformance with the evacuation route maps of which Tazewell County Civil Defense had earlier distributed some 40,000 copies. It may be surmised that some drivers followed the designated routes but police, auxillary police, and sheriff's deputies appear not to have considered enforcing any such routing.

Evacuation of Bartonville was decided by the authorities about 2:00 a.m., and residents were warned to get out. Movement was southward, to the west, and to the north and west. There was some movement into park areas in Peoria, from where some moved to the Bradley University Field House when the radio announced the opening of a reception center there. Other movement was to Glasford, Hanna City, Farmington, and even to Galesburg, 50 miles away.

Lack of highway congestion was reported, with the comment that people did not all evacuate at once. No information is available as to how many from the Bartonville area had moved out before the local warning action and announcements of the official decision to evacuate Bartonville.

The Peoria County Health Director and the Director of the Peoria State Hospital, located in the southern part of Bartonville, decided that no evacuation of the hospital was necessary, based on the forecast wind direction.

When an all clear was announced over the radio stations, the roads became clogged, with most evacuees trying to return home at one time. Again, however, there were no reported automobile accidents.

#### C. EMERGENCY SHELTER AND FEEDING

Five emergency shelters were opened under official auspices, one in Pekin High School, one in the Field House of Bradley University, the Kingman and Glen Oak schools in

Peoria and the gymnasium of the Morton High School. The Commanding Officer of the Hanna City Air Force Station (a radar installation) opened the base kitchen and restrooms. Shopping center parking lots were also centers of evacuee congregation.

The opening and operation of shelters was a combined effort with both the American Red Cross (A. R. C.) and the civil defense offices participating. The Red Cross, which assumes the authority in cases of natural disaster, moved in concert with civil defense on both sides of the river in this incident.

The Pekin Community High School was opened for the Pekin civil defense for use as a shelter at about 2:30 a. m. The Pekin chapter of the A. R. C. and the Salvation Army served coffee, doughnuts and milk, and were preparing to make sandwiches when the all clear was sounded. About 250 to 300 evacuees of all ages were served at the school. A civil defense order for cots from storage was cancelled when the all clear sounded at 5:05 a. m. The A. R. C. provided a registered nurse at this shelter.

Shelters were opened in Morton and in Farmington, but information was not obtained as to the numbers who were served, nor as to the other details.

The Peoria Chapter of the A. R. C. had the Bradley University Field House opened and manned, including a registered nurse, by a little after 3:00 a. m. Two Peoria Civil Defense communications men provided a CD radio link there. Coffee, milk, and doughnuts were served, and re-ordered. Emergency calls were made for diapers and for blankets, but only a few blankets were used before the "all clear" emptied the center.

No evacuees arrived at the Kingman School which had been opened by Peoria Civil Defense. About 55 arrived at the Glen Oak School where the Salvation Army assisted Civil Defense personnel.

About 500 people went to the Hanna City Air Force station, about 10 miles west of Peoria where coffee, milk, and toast were served, and restroom facilities were made available.

Records are not available as to just what announcements were made with respect to the reception centers, but the credit for dissemination of the information is given to the commercial radio stations. A means of informing the population as to where to go appears to be essential in a localized disaster of this nature where only a few of the 20 shelters available for Peoria were opened. The local radio stations met that need.

Approximately 1200 persons went to the reception centers, or less than 10 percent of the estimated 13,000 evacuees. An unknown number went to the homes of friends or relatives. Many are reported to have gone to parks, to shopping center and super market parking lots, others simply stopped along the roadside, while others continued to drive around.

The heat and humidity of the summer night, combined with the hurried evacuation of many in their night clothes, encouraged many not to go to the shelters, or if they went, to remain in their cars. As a result, the few shelters which were opened met the needs of the evacuees.

#### IV. COMMUNICATIONS

Warning was accomplished and evacuation achieved in spite of the absence of any coordinated or unified communications network. The police and fire departments of the communities on the east bank communicated by radio and by telephone as the need arose for assistance (ambulances, gas masks, etc.) or with respect to traffic control. The communications network is shown in Figure 2 , together with the two commercial radio facilities which provided a very real link to the public.

##### A. OFFICIAL RADIO NETS

Police and fire radio communication nets were of the utmost importance in the official sphere of action, although there was nothing which approached a centralized or coordinated communications center.

On the east side of the river, there are a number of radio nets. Creve Coeur and North Pekin operate a joint base station in the Creve Coeur municipal building which maintains contact with police and fire vehicles of both towns by means of a single radio frequency. Because of terrain masking, these vehicles cannot always contact each other, but nevertheless, the system seems to function satisfactorily. A dispatcher is on duty 24 hours a day at the station.

The Tazewell County Sheriff has a base station in Pekin. That station also transmits to the Marquette Heights police and fire vehicles when the messages are phoned to the station.

Radio base stations are also maintained by the Pekin Police Department, the Pekin Fire Department, the Tazewell County Civil Defense Director, the East Peoria Police Department and the East Peoria Fire Department.

On the west side of the river, Peoria dominates communications with its police communications center and fire operator. In addition, the Civil Defense communications center can monitor every police and fire net in the tri-county area. Bartonville has its own base station in the town hall, manned 24 hours a day. Police and fire vehicles are equipped with two way radios and in addition, the police car has a second radio on the Peoria police frequency.

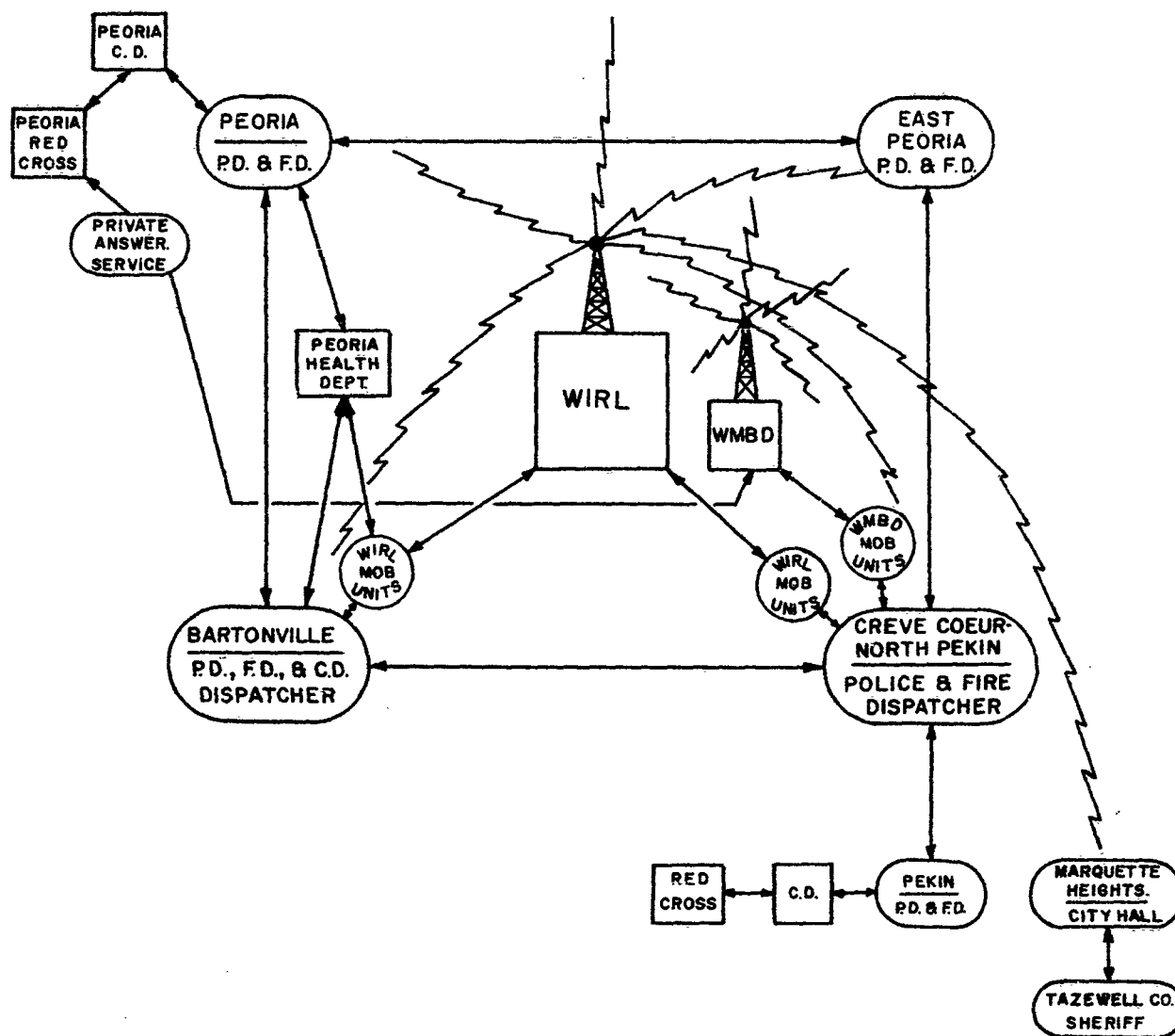


Figure 2. Communications pattern during the emergency.

Radio traffic was heavy on both sides of the river, and as usual under emergency conditions, records and logs were often incomplete. After the disaster, operators and dispatchers expressed the opinion that increased coordination and pre-emergency planning would have improved the efficiency of the operation. Communication within communities seems adequate, but communities are not organized. When a regional emergency required heavy communication traffic among communities, and between mobile units operating outside their usual territories with their own or other base stations, the system was not prepared to handle the task. When discussing the emergency with investigators, officials of all of the various towns expressed dissatisfaction with the availability of communication facilities.

#### B. TELEPHONE SERVICE

Telephone service in the area of the emergency is supplied by two companies: Peoria, Bartonville, East Peoria, and Creve Coeur are served by the Illinois Bell Telephone Company, while Marquette Heights, North Pekin, and Fekin are served by the Middle States Telephone Company of Illinois. Calls between the two company lines are toll calls even though they may connect telephones only a few hundred yards apart. The initial call for help from the men at the dock to the North Pekin Fire Department was such a call and required the assistance of the operator. Calls from Middle States phones to Illinois Bell numbers can be dialed directly by prefixing two extra digits, but calls in the reverse direction must be placed with a long distance operator.

The Middle States Telephone Company reported that between midnight and 7:00 A.M. on August 1 their equipment handled a total of 103 outgoing long distance calls, as opposed to a normal load of approximately 38. Local assistance calls and emergency calls requiring the assistance of an operator were not recorded, but they were reported to have been well in excess of the usual number. Although the regular staff was able to handle the increased work load, several operators had to be kept on duty beyond the end of their regular shift.

Officials of the Illinois Bell Telephone Company reported that 615 outgoing long distance calls were recorded between 1:10 and 7:00 A.M. on the day of the emergency as compared to a normal range of 150 to 160 between midnight and 7:00 A.M. During the same period, operators handled 248 requests for assistance in placing calls, including 43 local emergency calls, compared to an expected range of 1 to 24 calls. The normal work shift handled the load without assistance

and the group chief operator did not notify her supervisors until the regular day shift reported for work in the morning.

### C. RADIO BROADCASTING

Radio, telephones, word of mouth, sirens, and loudspeakers all played significant parts in this emergency. In the public mind, commercial broadcasting carried the day. Peoria has two 24-hour-a-day broadcasting stations, WIRL and WMBD. They are well known, highly publicized, and have a wide listening audience.

Station WIRL is active in promoting its "news tip" system of payments to the first person to phone in a report of a newsworthy happening. The station is often notified at virtually the same time as public agencies. In this case, a passer-by reported a "barge explosion" to WIRL as the dock workers were calling the North Pekin Fire Department. News reports were put on the air and units of the station's mobile fleet were dispatched to the scene. These mobile units are painted fire engine red, given picturesque names (e.g., "Big Red", "Little Red", and "Satellite"), and are promoted extensively by the station as part of the campaign to build a public image. Additional station personnel, including the news director, were called in as the seriousness of the situation became more apparent.

As a result of a flood of uncoordinated and unofficial telephone calls, WIRL announced that the towns of Creve Coeur, Marquette Heights, and North Pekin were to be evacuated. The only official who seems to have made any clear cut announcement was the mayor of Creve Coeur, who directed its evacuation. No record of his announcement was kept, so it is impossible to judge whether this announcement -- meant only for the threatened areas of Creve Coeur -- contained any elements which were the basis for the general evacuation.

In Marquette Heights, where most of the population resides on top of the bluff, town officials became upset by the evacuation announcement. They felt that the directive was unauthorized, unnecessary for their citizens, and a usurpation of power by the radio station. A series of telephone calls were made to WIRL (and later to WMBD) demanding that the situation be clarified and Marquette Heights residents not be included in evacuation announcements. They further requested that Marquette Heights residents be told to come back, since there was no danger to the heights area. Apparently at least one such announcement was transmitted over the radio, since many residents tried to return,

only to be stopped from entering the area by road blocks on the main highways. Long after the incident, there was strong resentment among Marquette Heights officials about the handling of the evacuation.

With the arrival of additional help, WIRL began broadcasting three requests:

- a) the public was asked to stop telephoning the station and to listen to the radio so as to clear the phone lines for official calls;
- b) officials were invited to call and pass on information directly to the public; they were told that they would be put directly on the air either through telephone calls or mobile units, and
- c) the public was asked to drive carefully and courteously and to avoid panic.

The barge captain was contacted by a mobile unit for accurate information about the barge, and this was provided after suitable editing to avoid alarming the public. Weather reports, which were checked and broadcast, aided the communications personnel in determining the possible path of the gas. Because the breeze was blowing the gas westward, the news director of WIRL realized that the town of Bartonville was in immediate danger and decided to concentrate on that area while continuing to give regular reports of progress on the east bank of the river where he felt that conditions were rapidly being brought under control. One mobile unit was sent to the Bartonville City Hall where it remained in constant contact with the mayor and the Peoria County Health Director.

Station WMBD had switched to automatic operation at 1:00 A.M., before learning of the incident, and for this reason did not immediately become actively involved in the emergency. A telephone answering service alerted one WMBD staff member, who called others. Mobile equipment was sent to the east bank, and the first radio report was broadcast at about 2:30 A.M. WMBD concentrated its limited force mostly on the east bank communities and broadcast announcements by local officials, as well as giving extensive news coverage to the emergency activities.



As evacuation centers were opened on both sides of the river the information was passed on to the public. When the "all clear" was announced over the radio at approximately 4:45 A.M., all evacuation centers were cleared within minutes. The radio stations continued to give news reports and to urge cautious driving.

#### D. GENERAL OBSERVATIONS

An important point which required further examination is that throughout this emergency communications personnel whose functions should normally be limited to maintaining contact between operating units and transmitting necessary information and instructions were forced to make decisions and to give directions because of the failure of any real leadership to assume control of the situation, a problem which will be discussed at greater length in the next section. Thus, communications people, i.e., radio announcers, had thrust upon them the necessity for deciding which individuals were worthy of attention, which information was reliable, who had the authority to order action, and finally, what action should be taken when no other orders were forthcoming. None of these functions is rightfully within the purview of the communications personnel.

## V. BEHAVIOR PATTERNS

### A. AUTHORITY PATTERNS

No centralized authority pattern took shape during the emergency although the area affected extended over a number of politically autonomous communities and over parts of two counties, with evacuation movement into several others. Officials in the two older towns, Bartonville and Creve Coeur, came forward with positive leadership despite evidence of hesitancy, confusion, and inadequate information. In North Pekin and Marquette Heights the police and fire department members seem to have done what was necessary without direction from higher authority.

County authority did not undertake control on either side of the river. Tazewell County sheriff's deputies established road blocks at the junction of routes 29 and 98, and at the junction of a secondary road from North Pekin which joins route 98 to block sightseers from the affected area. The sheriff's dispatcher relayed messages to Marquette Heights' emergency vehicles, but the sheriff's office assumed no other control or coordination of activities.

Civil defense organizations in both counties participated independently in the emergency activity. In Peoria County, the civil defense organization is centered in the city of Peoria, and since it is considered to be an extension of the normal operating agencies, civil defense participation in any emergency situation is taken for granted and notification was routine. Plans for all types of emergencies have been made in advance and rehearsed. Bartonville has its own civil defense organization. In Tazewell County, civil defense is a back-up organization, ready and waiting to be called upon if a situation proves to be beyond the capabilities of the normal operating agencies, but civil defense officials feel that to participate in any emergency they must be notified by responsible officials. About 200 members of civil defense organizations in Creve Coeur, Marquette Heights, Pekin, South Pekin, and Sunnyland participated. Cooperation between civil defense workers and the community operating agencies had not been strengthened by intensive emergency planning, nor had civil defense efforts gained popular support in Tazewell County.

The American Red Cross and the Salvation Army also participated in emergency shelter and feeding programs in both counties. While cooperation between the Red Cross and civil defense seems to be automatic and complete, there was evidence that some confusion exists in the minds of certain officials concerning the scope and degree of authority each organization enjoys.

As was mentioned in the previous section, the lack of any clearly identified authority figure to coordinate activities forced certain persons, notably communications personnel, to assume authority beyond their normal functions. Radio broadcasters, for instance, had to decide who should be put on the air to instruct the public. This problem would not have arisen if such decisions had been made well in advance of any emergency and all communications media had been supplied with priority ranked lists of officials authorized to make decisions and announcements.

Marquette Heights presents a pattern of response that deserves separate attention. City officials were genuinely disturbed by the "assumption of authority" over their citizens by outsiders. They resented the evacuation advice, which they felt had been given by "some radio announcer" who took it upon himself to make the decision. They felt that the Heights was never in any danger, and they carried on a prolonged telephone battle with radio station personnel and other officials during the emergency, insisting that the evacuation announcements be amended to send Marquette Heights residents home. Apparently, they gave no thought to the possible confusion that would result. When their demands were finally met and Marquette Heights residents were told they could return home, some officials were disturbed when returning residents were refused admittance through areas and via highways that were still dangerous. Much ill will was generated on both sides by this situation, and it was being discussed heatedly several weeks later. It is interesting to note that Marquette Heights is the most recently built and most recently incorporated area threatened by the gas. It was a "package development" project in which the developer planned for and installed all facilities. As a result, Marquette Heights has the lowest bonded debt and the lowest tax rate in the whole area. While the city has many solid, well

educated middle class residents, it also has a relatively high mobility rate. Neither the officials nor the citizens of Marquette Heights have been forced to learn to work together to acquire water systems, school systems, sewer systems, and all the other services required by municipal living, and there is not yet the tradition of argument, compromise, and self taxation that will eventually develop. In effect, the citizens do not yet have the "stake" in their town that residents of older areas have.

The investigators feel that the lack of real community ties was reflected in the lack of coordination displayed during the emergency. This suggests that a similar reaction pattern might be expected from the officials and residents of the many other "package development" communities springing up around the country.

#### B. INDIVIDUAL BEHAVIOR

The public quickly realized that the radio was their only source of information, and they utilized it. Nearly everyone reported listening to a home or car radio during the emergency, and they followed radio instructions unhesitatingly; two of the evacuation centers filled within minutes of announcements that they were open and emptied very quickly when the "all clear" was announced over the radio.

Nearly everyone who was initially alerted or awakened by some other means reported turning on the radio for information. Most followed the evacuation instructions without hesitation or question. However, nearly everyone took the time to check on neighbors, relatives, or pets before departing.

There were only a few persons who remained in their homes throughout the evacuation, and most of these were located in areas of marginal or doubtful danger. Even these people monitored the radio, and most reported that one or more household members stayed awake all night listening for news of developments.

There were a few people who displayed attitudes of defiance. At least one family stayed home in anger over what they felt was a political slight because they had not been notified directly. The emergency followed closely after installation of new office holders in all four evacuated towns, and political wounds had hardly had time to heal. Fortunately, in this instance, such compulsive behavior did not have the fatal results which would be possible under slightly altered circumstances.

Evacuees gathered in parking lots, small towns, parks, and other places. This seems to have been due to convenience rather than gregariousness. Most of those who went to evacuation centers stayed close to their cars, venturing into the centers periodically for refreshments or news. Several factors dictated this pattern: children were sleeping in the cars and parents stayed close, car radios kept the evacuees better informed than center announcements, the outdoors was more bearable than a crowded center on a hot, humid August night, and many people were uncomfortable or embarrassed in their night clothes. Colder weather would undoubtedly alter this pattern in favor of the shelters.

## VI. SUMMARY AND CONCLUSIONS

Approximately 13,000 residents of four politically autonomous municipal communities were aroused and warned of a hazard involving a toxic gas and evacuated from their homes between midnight and about 3:00 a.m. The evacuation was accomplished without panic or casualty and with only one very minor automobile accident, even though there was no overall coordination, direction, or control of the warning and evacuation activities. No estimate is possible as to whether civil defense planning and preparatory guidance made any contribution to the evacuation movement.

Intercommunity official radio communication nets were not completely interconnecting, though only Marquette Heights had no radio transmitting capability. There was no indication that "control" net frequency was in use to link all of the community control centers ("dispatchers"), though there were bilateral links and one joint (Creve Coeur - North Pekin) net with a single base station. A control net frequency would facilitate coordination, and could serve as a command net if an overall disaster control authority were established.

The use of fixed fire sirens as a system for warning the communities of hazard or disaster late at night was generally inadequate. A number of residents of the communities either did not hear the sirens, or were not sufficiently aroused to investigate the cause of their being sounded. It is concluded that reliance cannot be placed on fire sirens to arouse sleeping communities for evacuation and that disaster plans should include effective warning systems.

Loud speakers, door to door knocking, and telephone calls were effective in awakening the sleeping residents and, at the same time, informed them of the emergency need to evacuate the areas. Commercial radio broadcasting station personnel reported the accident and since they were initially unable to obtain authoritative information from official sources, exercised their judgement and announced the need to evacuate the areas east of the site of the disaster. Their coverage became more specific as mobile crews contacted officials of the municipalities, and their transmission of evacuation announcements and instructions were a principal channel by which the public was informed as to reception centers and, later, as to the "all clear".

A key factor in the success of the evacuation was the mutual cooperation of the citizens in verifying complete warning of neighbors and friends and in offering transportation to safety. This pattern was more evident in the older communities than in the newer "package development" where it appeared that the citizens had not yet evolved a tradition of cooperation as a means of accomplishing desired ends. Disaster planning should include recognition of the special problems faced by such newer communities.

The involvement of the several politically autonomous municipalities and areas suggests the need for some central authority to coordinate and possibly to direct warning and evacuation in event of local disaster.

It may be concluded that, as a minimum, some mutually agreed notification roster should be available at key points, e.g., police and fire headquarters, and communication (dispatcher) centers, civil defense offices, telephone control offices, and radio broadcast stations. Furthermore, the commercial radio stations should be recognized as principal channels for communication of information and instructions to the public, and they should be promptly linked to appropriate official sources.

No conclusion is possible as to the extent to which a regional civil defense organization might have provided some degree of coordination. The Tazewell County office did not receive timely notification, nor did it have directive authority. Although the county health officer was in the field, and operated directly with the Peoria city officials and with those of Bartonville, the Peoria Civil Defense Director was not notified until it appeared that Peoria might be affected.

The patterns and degrees to which local civil defense organizations were brought into the disaster suggest that primary reliance would have been placed on them only in case of enemy attack. Any such philosophy which relegates civil defense to uncertain, if not unlikely, future usefulness cannot but inhibit full support of those organizations. Integration of the several echelons of civil defense into plans to meet local disasters could bridge the autonomous authorities of local government units as well as provide for the realistic participation of civil defense organizations in local activities.

It may be concluded that the success of the warning and evacuation operations was due largely to the facts that individual initiative and mutual cooperation overcame a lack of overall official coordination and direction and that the public willingly accepted and followed reasonable direction from familiar sources.



## APPENDIX A

### THE AFFECTED COMMUNITIES

#### I. THE SETTING

The incident occurred in Creve Coeur, Illinois, in the Peoria metropolitan area which extends along both sides of the Illinois River at a point where it flows between bluffs 125 to 150 feet high. The meandering river, associated flood plain, and terraces occupy a valley approximately two miles wide lying NNE-SSW. The metropolitan area contains seven municipalities lying roughly north and south in close proximity to the river banks. Peoria and Bartonville occupy the northwest bank of the river and East Peoria, Creve Coeur, Marquette Heights, North Pekin, and Pekin occupy the southeast bank. The cities generally occupy the various fluvial plain levels, but Peoria, Creve Coeur, and Marquette Heights have spread to the plateau atop the bluffs as well. Four highway bridges cross from Peoria to East Peoria, one highway bridge crosses the river about three and a half miles north of East Peoria, and a highway bridge crosses the river at Pekin, about eight miles south of Peoria. The communities of Bartonville, Creve Coeur, North Pekin, and Marquette Heights were directly affected by the incident.

#### II. BRIEF HISTORICAL SKETCHES

Bartonville was first settled in the early 19th century. The village was named Bartonville in 1878 and incorporated in 1903. From the earliest period, the town was in industrial and mining community, and today the town has a high percentage of blue collar workers.

Creve Coeur, which was incorporated in the 1920's, grew up largely as a residential satellite for East Peoria, whose industries (especially the Caterpillar Tractor Company) are the major source of employment in the immediate area.

North Pekin is a residential community that was created during World War II to house part of the influx of industrial workers

into the area at that time. It was incorporated as a village in 1947, and today is still a community of younger industrial workers.

The youngest of the four communities is Marquette Heights. It was started in 1947 as an integrated sub-development on land previously used by Caterpillar as a proving ground, and a majority of the labor force living in Marquette Heights is now employed by the Caterpillar Company. The community was incorporated in 1956.

### III. LAND USE

All four towns are predominately residential areas. Marquette Heights is entirely residential, while the other towns have some commercial districts. All the industrial areas adjacent to the four towns are concentrated close to the river. In the case of Bartonville, the industrial area is almost entirely on the eastern edge of the village. All industry in the area of Creve Coeur, Marquette Heights, and North Pekin is located in the open area between these towns near the Peoria Lock and Dam on the Illinois River. This for the most part, is a "tank farm" area.

The land usage in the four towns is dictated somewhat by the extent of sloping ground. Only North Pekin is on essentially flat ground, i. e., the river plain. The other three communities are situated on the ridges on either side of the river plain.

#### A. Commercial Land Use

Central Peoria is the main focal point for major types of business activities. Local commercial operations exist in the four communities under study. In general, these are of the typical small suburban type, i. e., stores, restaurants, etc.

#### B. Industrial Land Use

The Caterpillar Tractor Company in East Peoria is the largest single industry and dominates the industrial picture; it employs approximately 21,000 persons. This is the place of employment for a very large percentage of the working force residing in Creve Coeur, Marquette Heights, and North Pekin. In the Bartonville area, Keystone Steel and Wire Company employs 3,000 persons; Creve Coeur and North Pekin each have a small industrial

business; Marquette Heights has none.

#### IV. TRANSPORTATION

There is limited inter-city bus service for Bartonville, Creve Coeur, and North Pekin; it was not determined whether Marquette Heights has any scheduled bus service. However, mobility of all the residents in the affected area was excellent, since most households own automobiles. Nearly all the evacuees used their own vehicles to leave the area. Those who did not have cars had no difficulty obtaining transportation from neighbors.

#### V. DEMOGRAPHY

Demographic statistics for the affected communities are given in Tables A-I and A-II, from figures extracted from 1960 U. S. Census reports.

Figure A-I illustrates the comparative age distributions within the affected communities. The investigators feel that the relatively large percentage in Marquette Heights of young children in contrast to the low percentage of elderly people and the opposite condition in Bartonville may be of significance in analyzing the behavior patterns of these communities.

TABLE A-I  
POPULATION CHARACTERISTICS

Characteristic	Affected Community			
	Bartonville	Creve Coeur	Marquette Heights	North Pekin
Total Population	4680	6684	2517	3688
No. of Households	1408	1927	559	961
Population in Group				
Quarters	32	10	0	0
Population per Household	3.30	3.46	4.50	3.84

TABLE A-II

## COMMUNITY POPULATION GROWTH (1910-1960)

Community	Year					
	<u>1910</u>	<u>1920</u>	<u>1930</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>
Bartonville	1536 <sup>a/</sup>	1580	1886	1879	2437 <sup>b/</sup>	7327
Creve Coeur			350 <sup>c/</sup>	3535	5499 <sup>d/</sup>	6689
North Pekin					1758 <sup>e/</sup>	2025
Marquette Heights						2517 <sup>f/</sup>

a. Incorporated 1903

b. Part of Limestone Twp. annexed to Bartonville in 1949

c. Creve Coeur incorporated in 1920's.

d. Parts of Pekin Twp. annexed to Creve Coeur Village in 1946.

Parts of Groveland Township annexed to Creve Coeur Village

e. North Pekin incorporated in 1947

f. Marquette Heights incorporated 1956(?)

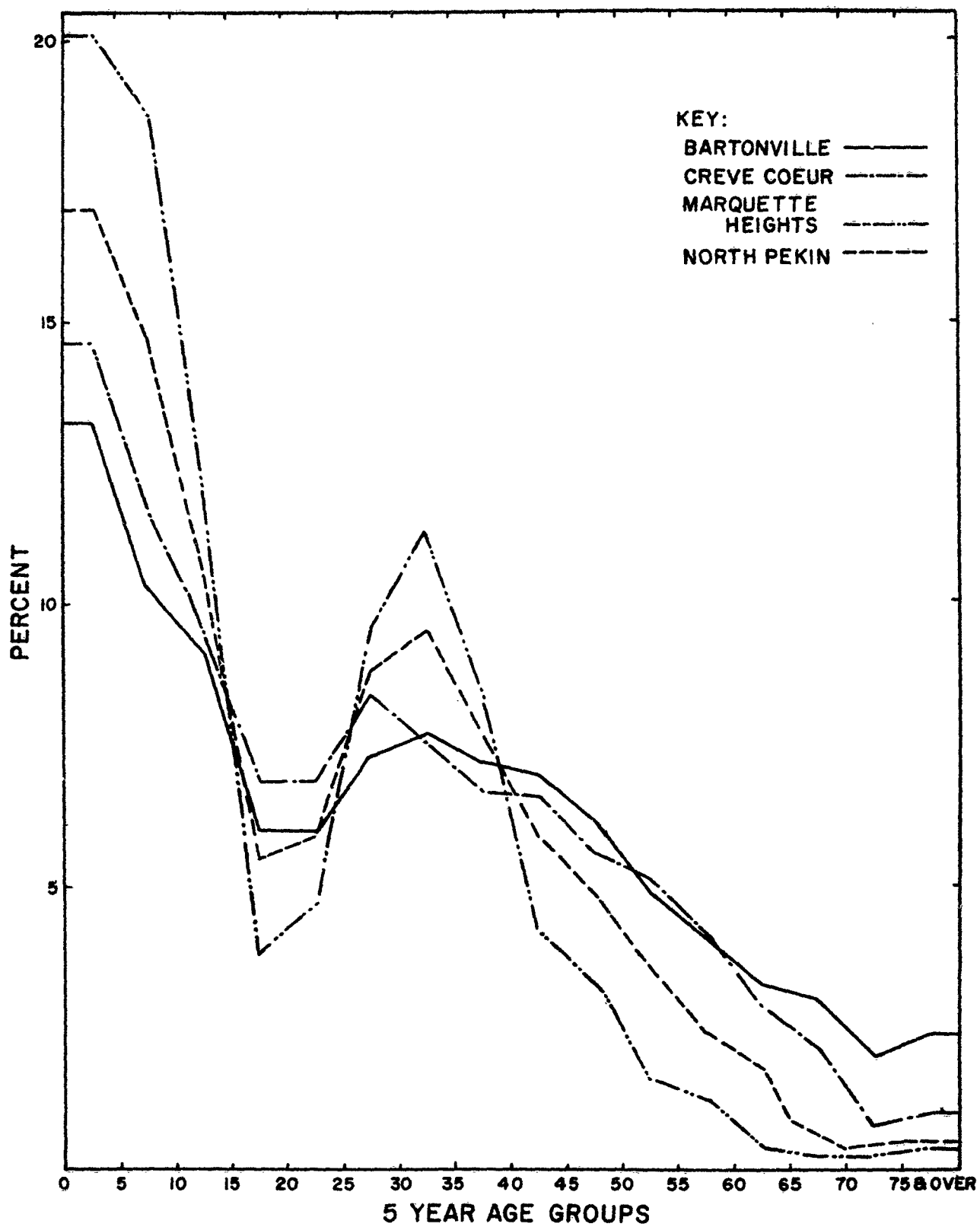


Figure A-1. Comparative age distributions within the populations of the affected communities.

## APPENDIX B

### LOCAL STRUCTURE OF GOVERNMENT

In this section, a discussion of the political structure of the affected communities is presented. The specific description of these political units is preceded by an explanation of the general legally-constituted governmental forms. Figure B-1 illustrates the relationship of state to county, cities and village, and smaller units.

#### I. COUNTY

The affected area lies within Peoria and Tazewell Counties.

##### A. County Board

The unit of general jurisdiction is the county. The government body of the county is the county board whose members are the township supervisors and assistant supervisors. The township supervisor has important duties as the chief township official as well as serving on the county board. The assistant supervisors, however, have no township duties and only serve on county boards. As of 1960, Peoria County had 38 supervisors, and Tazewell, 37.

The county board operates chiefly as an administrative agent of the state. Its chief functions are: providing and maintaining a suitable courthouse, jail, and other necessary county buildings; assisting in elections by delineating election districts, designating polling places, providing election supplies, and selecting, subject to the approval of the county judge, election judges and clerks; selecting grand jurors; altering boundaries of townships and road districts; approving "road and bridge" tax levies; sitting ex officio as board of review for tax assessments; and maintaining uniformity in assessing through appointment of a county supervisor of assessments. To carry out these functions, the board has the power to make contracts for the county, manage county funds, and settle claims against the county.

##### B. Elected Officials

Important powers are given to independently elected county officials. Typical ones are: County Clerk, County Auditor, State's Attorney, Superintendent of Schools, Clerk of the Circuit Court,

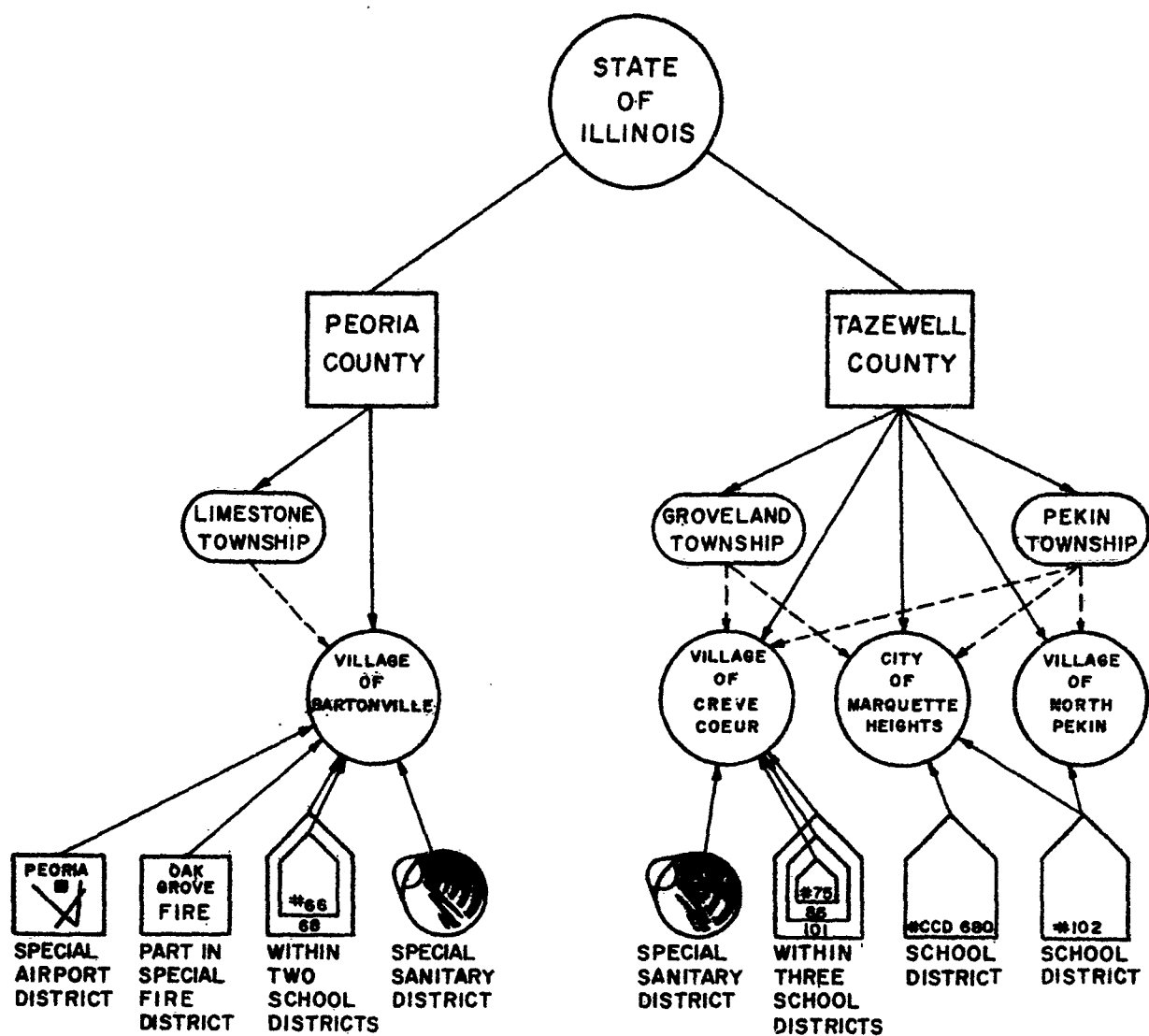


Figure B-1. Relationship of state, county, township, municipal, and special government units.

Recorder of Deeds, Coroner, Sheriff, County Treasurer, Probate Judge, Clerk of the Probate Court, and County Judge (combined with the Probate Judge in Tazewell County).

The County Clerk is perhaps the nearest thing to a County Administrator; at least, he has the widest range of duties. He acts as a clerk for the County Court and the Board of Supervisors. He supervises elections; prepares tax assessment books, extends the levies, and mails out the tax bills.

The chief law enforcement officers are the Sheriff and the State's Attorney. The Sheriff, in addition to his function of keeping the peace in unincorporated areas, works for the judiciary in executing writs, warrants, and processes of all courts of record in his jurisdiction.

Although the county board has some control over elected officers through its fiscal powers, it can not exercise direction over these officers or compel them to coordinate their activities.

## II. TOWNSHIP

Township boundaries normally follow survey lines and resemble a square with six-mile sides. However, there are many exceptions where township lines are aligned with county lines and rivers, as for example, in Pekin Township; Limestone and Groveland Townships are six-mile squares.

### A. Township Meetings

The township has no governing board. Its business is transacted by the public at the annual town meeting or at special meetings which can be called from time to time. At the annual meeting, salaries of town officials are set, a levy of road and bridge taxes is determined, and a budget and appropriation ordinance are adopted. The township has jurisdiction over the unincorporated areas within its boundaries, but collects taxes from all citizens in the incorporated as well as unincorporated areas within its boundaries.

### B. Elected Officials

The chief official of the township is the supervisor who, besides representing his township on the county board of supervisors,



administers the financial affairs of the township. As mentioned before, assistant supervisors have no township duties but are elected solely to give additional representation to the more populous townships on the county board of supervisors. The town clerk has custody of all township documents, administers oaths, and keeps a record of the proceedings of all town meetings. The board of town auditors, consisting of the supervisor, the clerk, and three other members elected at large from the township, has as its chief function the auditing of all financial transactions of the township.

### III. INCORPORATED CITIES AND VILLAGES

Bartonville, Creve Coeur, and North Pekin are incorporated as villages. Marquette Heights is a city. The only distinction between cities and villages is in their size when they first incorporated. To incorporate as a city, the proposed area must not exceed four square miles and have not less than 1,000 inhabitants. For villages, the proposed area must not exceed two square miles and must have at least 100 inhabitants. There are no restrictions relating to proximity to existing municipalities. However, the term village or city has no significance in describing the current size or status of the municipality.

#### A. Forms of Government

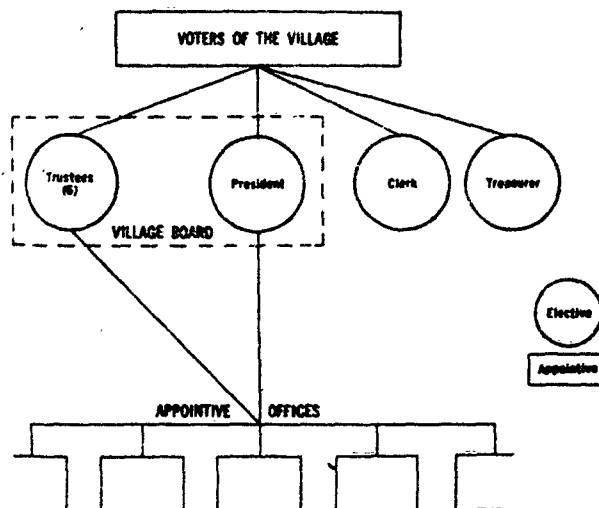
There are four types of governing organizations in Illinois municipalities: trustee, mayor-council, commission, and council-manager. Peoria has the council-manager form. Marquette Heights has the Mayor-council (or aldermanic) form, and the other three municipalities under study here have the trustee form of government.

The trustee form is a relatively simple form adequate for small villages. The mayor-council form, used in cities, is similar to the trustee form except that the aldermen are elected by wards to give district representation. See Figure B-2.

### IV. COMMUNITY FACILITIES

Community facilities provided by cities and villages include fire stations, local streets, small parks and playgrounds, and, in some cases, sewerage and utility systems. Schools, libraries, hospitals, major parks, sanitary systems, and utility systems are provided by

# TRUSTEE FORM (Bartonville, Creve Coeur, North Pekin)



# MAYOR-COUNCIL FORM (Marquette Heights)

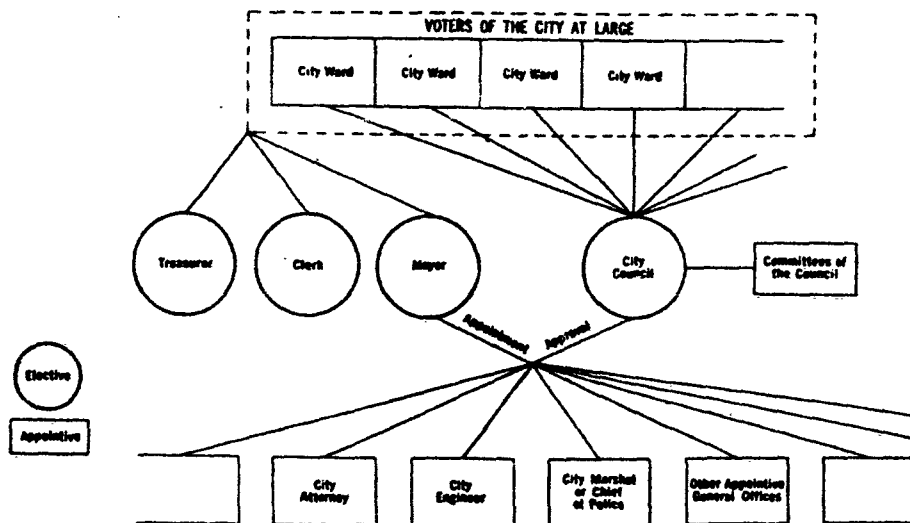


Figure B-2. Forms of municipal government in the affected communities.

special districts or private agencies. Special Districts are established on a local or regional level, not necessarily following established political boundaries.

#### A. Utilities

In the urban core of Bartonville, Peoria, and Creve Coeur sewerage facilities are provided by special districts (E. Peoria, Creve Coeur, and Great Peoria Sanitary Districts), whereas private companies provide water and power. Bartonville's water supply comes from the Peoria Water Works Company. Marquette Heights and Creve Coeur own their own water works. The investigators did not learn the source of N. Pekin's water. The area is served by the Central Illinois Light Company (CILCO). Telephone service is provided in Bartonville and Creve Coeur by the Illinois Bell Telephone Company, with local central offices in Peoria. Marquette Heights and North Pekin are served by the Middle States Telephone Company, whose local central office is in Pekin.

#### B. Special Districts

Under the Illinois system of government it has become necessary for communities or regions to establish special districts to provide services which are not traditionally provided by the established state, county, township, or city governments. The special district also has become a way to circumvent city or village tax levy limits set by the statutes. Although there are many arguments against this "proliferation" of local government units, nevertheless, it sometimes is the only way to provide regional libraries, sewer systems, fire protection, etc. This is particularly true in rural areas with low population density. Often, in the metropolitan areas such regional services as airports are supported by special districts. This is true in the Peoria area.

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